COURSE OF STUDIES

GRADE EIGHT SCIENCE

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A. PROGRAM RATIONALE AND PHILOSOPHY

"The aim of education is to develop the knowledge, the skills and the positive attitudes of individuals, so that they will be self-confident, capable and committed to setting goals, making informed choices and acting in ways that will improve their own lives and the life of their community."

Secondary Education in Alberta, 1985

Science education contributes to this overall aim of education in several ways:

- first, by providing learning experiences that help students understand and interpret the world in which they live
- second, by developing knowledge, skills and attitudes that support the intelligent and responsible application of science and technology, and
- third, by developing a foundation of knowledge, skills and attitudes that support further study of the sciences.

To achieve these purposes, the Junior High Science Program provides a broad range of learning experiences in the biological, physical and earth sciences. In continuity with the elementary and senior high programs, the junior high program provides opportunity for study or most of the major branches of sciences building in the experiences of the elementary school and providing a foundation for more formal studies at the senior high level.

In keeping with the developmental level of students, concepts are introduced through a broad range of experiences, including those based on first-hand investigation. Attention is also given to the development of information accessing and research skills and the use of technological materials (e.g., computers and interface devices). Learning based on these experiences are extended as students are given opportunities to reflect on their experiences, learning to discover and construct meaning through careful and focused thought. Learning activities are thus designed not only to illustrate established science ideas, but also to allow students to construct new meanings and find new applications to what they learn.

Learnings within the program are presented in contexts that illustrate the development and application of science. Frequent attention is given to the processes by which scientific knowledge is gathered, largely by involving students directly in the practice of scientific inquiry. Significant attention is also given to other contexts of science: in particular the application of science to the solution of practical problems, and the examination of the implications of science and technology with respect to personal and social impact. The processes of problem solving and decision making are given direct attention in learning activities: students are thus involved in ways that will stimulate their critical and creative thinking skills.

In broad terms, the intended outcome of the secondary science program is the development a scientifically literate citizenry. A scientifically literate person is one who:

- demonstrate a working knowledge and practical understanding of the sciences
- has the ability to evaluate scientific evidence
- understands the processes by which scientific knowledge is developed and can adapt those processes for personal use
- applies science concepts, theories and processes to the investigation of everyday problems
- understands the relationship of science and technology
- demonstrates awareness of how science and technology can function responsibly in a social context
- recognizes the limitations as well as the usefulness of science and technology in advancing human welfare, and
- demonstrates a continuing interest in science and technology

B. GENERAL LEARNER EXPECTATIONS

These general learner expectations are to be developed through the program as a whole with particular attention to be given in designated units, as identified in individual unit outlines. General learner expectations are listed in association with three major areas of emphasis:

Nature of Science
Science and Technology
Science, Technology and Society

Concepts, skills and attitudes have been identified for each of these three areas of emphasis as well as for specific units at each grade level. Note that each area of emphasis provides an overall context for learning basic scientific concepts and principles related to students' experiences. One of these contexts provides the primary basis for development of each unit in the program.

NATURE OF SCIENCE

Attitudes

Students will be encouraged to develop:

1. Curiosity about events and objects in the natural world.
2. Appreciation of the beauty and complexity of the natural world.
3. Respect for accuracy and precision.
4. Honesty and completeness in reporting and evaluating observable data.
5. Open-mindedness in considering alternative ideas and interpretations.
6. Critical-mindedness in evaluating inferences and conclusions.
7. Confidence in personal ability to design and conduct a scientifically investigation.

Science Inquiry Skills

Students will demonstrate:

1. Questioning
   - recognizing patterns and discrepant events
   - identifying and asking relevant questions
2. Proposing Ideas
   - hypothesizing
   - predicting
3. Designing Experiments
   - identifying and controlling variables
   - developing procedures
4. Gathering Data
   - observing
   - measuring
5. Processing Data
   - organizing and presenting data
   - identifying patterns and trends
6. Interpreting Data
   - inferring
   - developing theoretical explanations

Concepts

Students will demonstrate an understanding that:

1. Science is a disciplined way to develop explanations for natural phenomena.
2. Scientific knowledge is cumulative and subject to change.
3. Significant aspects of the scientific enterprise include:
   - observable data that can be repeatedly demonstrated in various places, at different times, by different investigators
   - experimentation (scientific inquiry) as a means to support, modify, or reject proposed ideas about natural phenomena
   - interpretations and conceptual inventions that are theoretical in nature

SCIENCE AND TECHNOLOGY

Attitudes

Students will be encouraged to develop the following attitudes:

1. Appreciation of the need for technological devices and processes to serve human needs.
2. Appreciation of the contribution of science to the solution of practical problems.
3. Awareness of alternatives in the approach to technological problems.
4. Respect for the creative and critical thinking processes.
5. Appreciation of good design (from an aesthetic as well as a functional perspective).
6. Willingness to take initiative in dealing with practical problems.
7. Confidence in personal ability to solve practical problems.

Technological Problems in Solving Skills

Students will demonstrate the following skills:

1. Understanding the purpose
   - identifying the purpose
   - identifying specific requirements (specifications)
2. Developing a Plan
   - identifying alternatives
   - planning and designing
3. Carrying Out the Plan
   - testing the design
   - troubleshooting
4. Evaluating
   - evaluating the design
   - evaluating the planning process

Concepts

Students will demonstrate an understanding that:

1. Science and technology are interrelated:
   - the development of new technologies may open new areas for scientific investigation
   - solving technological problems frequently involves the application of scientific knowledge.
2. Technology is a process of solving practical problems.
3. Significant aspects of the technological problem-solving process include:
   - approaching the problem in a planned way
   - development of a practical design as a means to support, modify, or reject alternative ideas for solving the problem.
   - creativity and inventiveness in developing solutions that achieve the intended purpose
   - critical thinking in the evaluation of potential solutions and in the identification of areas in which improvement might be made.
4. Technological development involves both products and processes.
5. Technologies arise from common practices and traditions as well as from the creative applications of scientific knowledge.

SCIENCE, TECHNOLOGY AND SOCIETY

Attitudes

Students will be encouraged to develop the following attitudes:

1. Appreciation of the need for informed decisions making at both personal and societal levels.
2. Appreciation of the contributions and limitations of scientific and technological knowledge to the societal decision-making process.
3. Confidence in using scientific and technological knowledge to inform personal decision making.
4. Commitment to the pursuit of knowledge and the responsible application of that knowledge.
5. Appreciation of different perspectives that bear upon the societal decision-making process.
6. Respect for the perspectives and viewpoints of others.

Decision-Making Skills

Students will demonstrate the following skills:

1. Identifying the Issue
2. Identifying the Alternatives
3. Researching
    - examining background information
    - examining perspectives on each alternative
    - identifying consequences of each alternative
4. Reflecting and Deciding
    - considering consequences
    - considering perspectives
    - building consensus
5. Taking Action
    - demonstrating responsibility through personal action
    - demonstrating responsibility through actions as a member of a group
6. Evaluating
    - evaluating effects of actions
    - evaluating the decision-making process used

Concepts

Students will demonstrate an understanding that:

1. Knowledge of science and technology helps inform the societal decision-making process.
2. Societal decision making aims at choosing actions most appropriate for existing circumstances by comparing and evaluating the consequences of alternative proposals.
3. The societal decision-making process works toward building a consensus. Significant aspects of social decision making include:
    - recognition of the advantages and limitations of scientific and technological knowledge for informing the process
    - consideration of other perspectives (e.g., economic, ethical, political), in addition to scientific and technological perspectives, in informing decision making about science related issues.
    - deliberation as a means to clarify, support, modify, or reject alternative proposals for action
    - recognition of the need for trade-offs in order to achieve workable solutions in science-technology-society problems.
4. Relationships among science and technology, and societal decision making occur at many levels:
    - developments in science and technology often significantly impact on society
    - societal needs and concerns often stimulate or influence technological problem solving and scientific inquiry.
5. Many of the effects of science and technology on society are unforeseen.

C. CONTENT

1. TOPICS OF STUDY

The program is comprised of six units at each grade level. Each unit focuses on a particular science topic and develops a learning context that contributes to the student's overall understanding of science and technology.

The instructional time for each unit varies, but at each level the program is based on 100 hours of instructional time.

2. REQUIRED/ELECTIVE COMPONENTS

Each unit of the program has a required component and an elective component, defined as follows:

The required component encompasses the knowledge, skills and attitudes that all students should be expected to acquire. This component comprises 80% of the program.

The elective component, which comprises 20% of the program, provides opportunities to adapt and enhance instruction to meet the diverse needs, abilities and interest of individual students. It encourages enrichment and remediation consistent with the content and objectives of the required component.

The program content for both the required component and the elective component is defined by the same statements of objectives.

3. OPTIONAL CONTENT

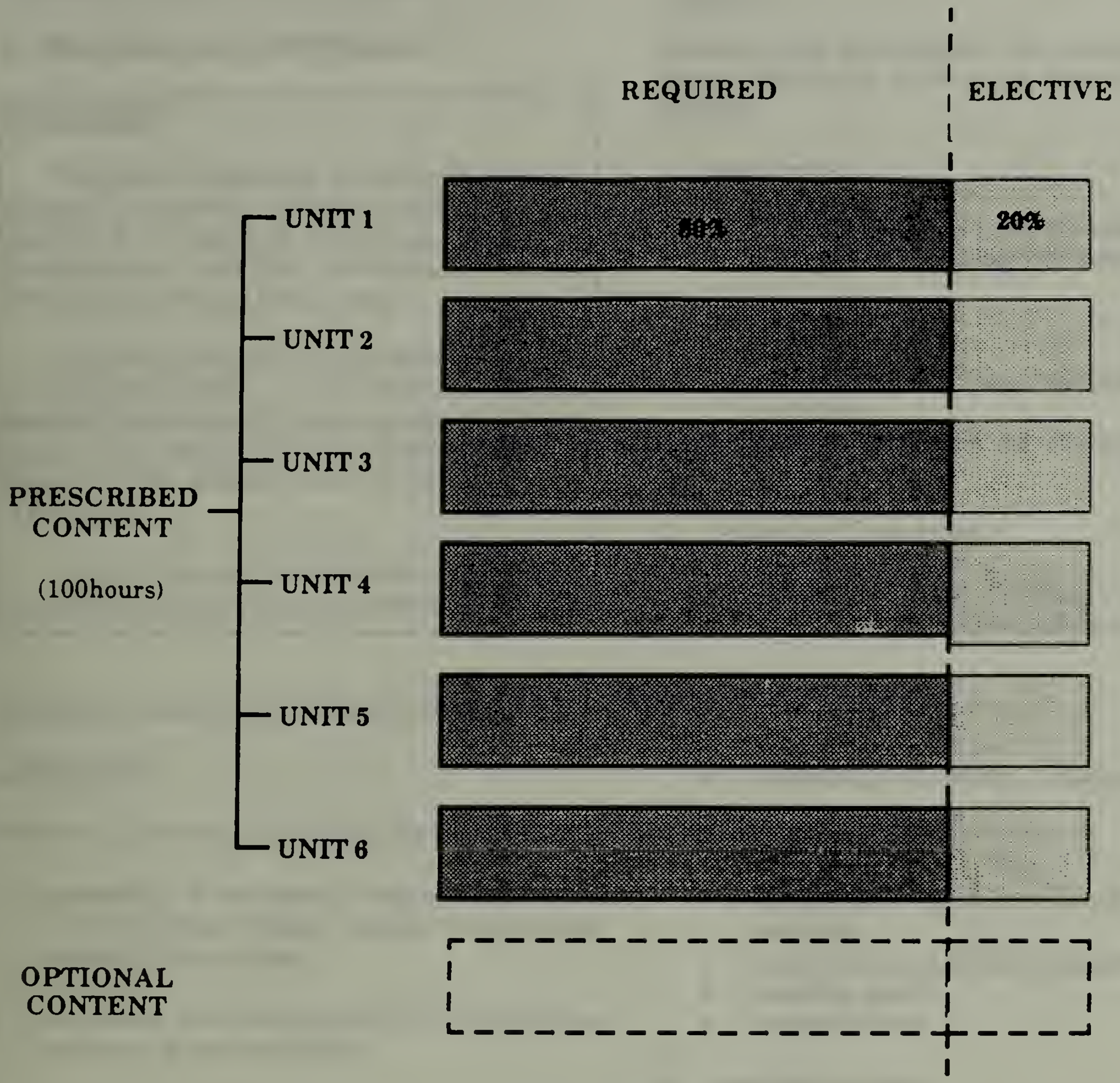
(Note: there will be no requirement that optional content be included within a school's Junior High Science Program.)

Instructional content that is provided beyond the mandatory 100 hours of instruction shall be deemed to be optional, Optional content to the program may take several forms:

- an extension of a prescribed unit
- a suggested option identified in the *Teacher Resource Manual*
- an option based on local choice

Selection of topics for development as optional units may be made at the local school levels based on local needs and resources. To assist the school in the choice and development of topics, brief outlines will be provided and, where available, resources will be identified. Optional topics may include include units that have been developed or selected locally, subject to the following provisions being met.

- All program content must support the overall goals of the program.
- Inclusion of optional content must not detract from the achievement of required program objectives or from elective content associated with the required program.
- Optional content must not duplicate or unduly overlap content to be developed in a subsequent year of the secondary science program.


REQUIRED
ELECTIVE
UNIT 1
80%
20%
UNIT 2
UNIT 3
PRESCRIBED CONTENT
(100hours)
UNIT 4
UNIT 5
UNIT 6
OPTIONAL CONTENT

GRADE EIGHT PROGRAM

1. Solutions and Substances

OVERVIEW

The major emphasis of this unit is on the nature of science. Opportunities are also provided to support learnings regarding technologies and the relationship among science, technology and society.

This unit provides an introductory study of solution chemistry. Unit activities engage students in the scientific investigation of different kinds of solutions and their properties. Through these activities, students learn the basic principles of solubility.

Opportunities are also provided to examine practical problems in solution chemistry.

SPECIFIC LEARNER EXPECTATIONS

ATTITUDES

Students will be encouraged to develop:

1. appreciation of the extent to which solutions are a part of living things, natural products and manufactured products
2. awareness and appreciation of crystalline structures in solid materials
3. awareness of solution chemistry as a practical science
4. confidence in personal ability to investigate material properties and processes
5. awareness of potential dangers of handling unknown materials

SKILLS

Students will demonstrate the following science inquiry skills, with emphasis on those that appear in boldface.

1. Questioning
   - recognizing patterns and discrepant events
   - identifying and asking relevant questions
2. Proposing Ideas
   - **hypothesizing relationships between variables**
   - **predicting based on extrapolation of trends**
3. Designing Experiments
   - **identifying and controlling variables**
   - **developing experimental procedures**
4. Gathering Data
   - **observing**
   - **measuring solubility of materials**
5. Processing Data
   - **classifying materials according to their solubility**
   - **organizing and presenting data**
   - **charting data**
   - **graphing data**
6. Interpreting Data
   - **inferring the solubility of different materials**
   - **inferring the effect of conditions on the solubility of different materials**
   - **developing theoretical explanations**

CONCEPTS

1. Solutions can be found in many forms, both in natural and human-made materials.

Students will be expected to:

- distinguish between homogeneous mixtures (solutions) and heterogeneous mixtures
- identify examples of aqueous and non-aqueous solutions
- identify examples of solutions in natural and human-made materials

2. Solutions can be described in terms of their composition, their concentration and their physical properties.

Students will be expected to :

- distinguish between solute and solvent
- identify solute and solvent in various kinds of solutions
- describe and give examples of the concept of solubility
- describe the concentration of a solution in both general terms and in numeric terms
- describe the effects of various solutes in aqueous solution on the properties of that solution (e.g., physical appearance, freezing point, boiling point)

3. The rate at which materials dissolve is found to vary with the conditions of solution.

Students will be expected to :

- recognize that the amount of a solute that will dissolve in a given solvent generally has an upper limit (saturation point)
- compare the solubility of different materials
- recognize and describe the effect of temperature on solubility of materials
- distinguish between solubility and rate of dissolving
- recognize and describe the effects of particle size on the rate of dissolving
- recognize and describe the effects of mechanical movement on the rate of dissolving

4. Knowledge of solubility can be applied to the separation of materials.

Students will be expected to:

- identify procedures that can be used for the separation of mixture into their components, and describe the principles on which they are based (e.g., settling, filtration, evaporation distillation, crystallization)
- apply techniques of filtration
- describe and carry out specific techniques for recovery of solutes from aqueous solutions (e.g., evaporation, distillation, crystallization)
- identify and describe examples of the separation of solutes from non-aqueous solutions

2. Energy and Machines

OVERVIEW

The major emphasis of this unit is on science and technology. Opportunities are also provided to support learning regarding the relationship among science, technology and society.

This unit provides a study of mechanical systems with a focus on their efficiency and effectiveness. The concepts of systems and subsystems are introduced early in the unit; these concepts are used throughout the unit in interpreting various kinds of mechanical devices.

Opportunities are provided in the unit for students to construct devices that will perform given functions and to make improvements to those devices. In the process, students consider the need for efficiency in design and they become aware of the practical approaches to the conservation of energy. An awareness of the various forms of energy and energy conversions are also developed within this unit.

SPECIFIC LEARNER EXPECTATIONS

ATTITUDES

Students will be encouraged to develop:

1. awareness that practical problems can often be solved in multiple ways
2. respect for the diversity of approach exhibited by others in their search for solutions to practical problems
3. confidence in personal ability to solve practical problems
4. awareness of the role of efficiency in good design

SKILLS

Students will demonstrate the following technological problem-solving skills, with emphasis on those that appear in boldface:

1. Understanding the Problem
   - **identifying the purpose**
   - identifying specific requirements (specifications)
2. Developing a Plan
   - **planning and designing a mechanical device which will accomplish a specific task through the application and transfer of energy**
   - **identifying alternative design solutions in the building of a mechanical device**
3. Carrying Out the Plan
   - **testing the design by constructing a simple mechanical device**
   - **troubleshooting the design: identifying and correcting practical problems in a mechanical device**
     - **identifying problems due to excessive friction**
     - **identifying problems in the fit or meshing of moving parts**
     - **improvising practical remedies to problems encountered**
4. Evaluating
   - **evaluating the design**
   - evaluating the planning process

CONCEPTS

1. Mechanical devices can be understood as systems that are made up of subsystems and components.

   Students will be expected to:

   - identify parts or components of some simple mechanical devices (e.g., mechanical pen, stapler)
   - identify parts of a mechanical device that work together as a subsystem

2. Mechanical systems are designed to perform one or more functions.

Students will be expected to:

- identify the functions of some common mechanical devices
- identify the contribution of subsystems to the overall function of a mechanical device
- identify the contribution of individual components to the functions of a mechanical device
- identify components that operate as simple machines
- describe principles by which simple machines are operated and applied
- describe the bicycle as an example of a mechanical system
- compare alternative designs of a mechanical device; e.g., compare propulsion systems in toy cars

3. Transmission of power between different parts of a system can be accomplished through various kinds of linkages.

Students will be expected to:

- identify the source of power in some familiar mechanical devices
- identify power linkages within a mechanical system (e.g., belt driven and gear driven systems)
- analyze a gear system to identify the effect of different gear ratios
- build or adapt a mechanical system to provide for different turning ratios between a driving and a driven shaft

4. Mechanical systems convert energy from one form to another.

Students will be expected to:

- identify examples of energy conversion
- identify modifications to a device that would enable it to use more than one form of energy input

5. The efficiency of mechanical devices can often be improved through changes in design and by alterations that reduce friction.

Students will be expected to:

- construct a device that makes efficient use of energy
- identify changes in the design of a mechanical device that would improve its overall efficiency
- identify improvements in the design of a mechanical device that would improve its safety and ease of operation
- improve the efficiency of the device by "troubleshooting"
- interpret information on energy efficiency of different devices or products (e.g., fuel consumption of automobiles, electrical power consumption of household appliances)
- identify impacts of inefficient energy use on environments and resources

3. Consumer Product Testing

OVERVIEW

The major emphasis of this unit is on the science, technology and society. Opportunities are also provided to support learning regarding technologies and the nature of science, technology and society.

This unit provides for a study of consumer product testing, with a focus on the social need for safe, reliable and effective products. The need for quality information that will serve individual and public decision making is the overall context for this study.

Through sample investigations and the study of textual materials, students learn the basics of experimental design for product testing. Results of investigations are then considered in relation to the process of decision making, including personal decisions concerning the selection of products and societal decisions about what should be allowed in the marketplace. In sample studies, students consider various criteria for decision making including economic and environmental considerations as well as product effectiveness. An introduction to the setting of standards is also a part of this unit.

SPECIFIC LEARNER EXPECTATIONS

ATTITUDES

Students will be encouraged to develop:

1. awareness of environmental impacts of consumer products
2. awareness of ethical problems in the use of animals in product testing research
3. awareness that a product may be safe to use in one application but dangerous to use in another
4. awareness that products may affect different individuals in different ways
5. confidence in personal ability to evaluate a product

SKILLS

Students will demonstrate the following science inquiry skills, with emphasis on those skills that appear in boldface.

1. **Identifying issues and concerns regarding the development of consumer products that are safe, reliable, and make appropriate use of resources.**
2. **Identifying alternatives in the design of consumer products.**
3. **Researching**
   - **designing experiments to test consumer products**
   - **examining and evaluating information about alternative products**
   - **examining personal, social and environmental perspectives on each alternative**
   - **identifying consequences of each alternative**
4. **Reflecting and Deciding**
   - **considering alternatives**
   - **considering perspectives**
   - **building consensus**
5. **Taking Action**
   - **demonstrating responsibility through personal actions**
   - demonstrating responsibility in actions as a member of a group
6. **Evaluating**
   - **evaluating effects of actions**
   - **evaluating the decision-making process**

CONCEPTS

1. Consumer products each have a variety of characteristics which might be considered in evaluating the quality and effectiveness of the product.

   Students will be expected to:

   - identify characteristics that contribute to the overall quality of a product

- distinguish between product characteristics that are significant to the primary function of a product and those characteristics that are not
- identify consumer expectations regarding the function and effectiveness of given products
- recognize safety, reliability and durability as significant product characteristics
- recognize examples of variation in the quality of a product
- analyze ways in which a sample product might fail and identify areas where defects might occur

2. Product testing provides profiles of significant characteristics that can assist those making decisions regarding the product.

   Students will be expected to:

   - design and carry out tests of selected characteristics of a particular product
   - design and carry out a controlled investigation in which two or more products are compared with respect to selected characteristics
   - evaluate methods used to test products
   - describe the use of product test information at various stages of decision making (e.g., product development stage, quality control, consumer selection)
   - identify the kind of tests that might be carried out to evaluate a particular product claim
   - identify the kinds of information that can assist consumer decisions regarding a product

3. Standards are required to assure that consumer products meet minimum expectations and that products can be used safely.

   Students will be expected to:

   - identify qualities and/or performances of a product for which standards might be set
   - explain the need for standards in packaging, labelling and advertisement (relative to consumer needs for appropriate and accurate product information)
   - describe the responsibility of producers and marketers in ensuring that advertisements are consistent with actual product characteristics
   - recognize product characteristics that may be required for particular applications or for particular consumers (e.g., on the basis of physical characteristics, allergies and disabilities)
   - identify conditions of use that are relevant to the safe use of sample products

4. Decisions regarding consumer products involve consideration of alternatives and implications.

   Students will be expected to:

   - identify impacts of the production, use and disposal of products on environments and on living things in those environments
   - identify examples of health and safety problems which might occur through use of consumer products
   - identify impacts of particular products on individuals and on society
   - identify decisions that need to be made at a personal and at a societal level
   - recognize the contribution of scientific information to effective decision making regarding consumer products

4. The Earth's Crust

OVERVIEW

The major emphasis of this unit is on the nature of science. Opportunities are also provided to support learning regarding technologies and the relationship among science, technology and society.

This unit studies features of the earth's crust that can be interpreted through examination of earth materials and formations.

In continuation of work begun in Grade 7, students consider ongoing processes of earth change, with a particular focus on changes that lead to the formation of new rocks and new formations. Volcanic action, earthquakes, crustal movements and sedimentation are considered in this connection.

Earth materials are studied both from the perspective of examining individual rocks and rock families and by a study of the formations in which rocks are found. The fossil record is introduced and the usefulness of this record in interpreting earth changes is considered.

SPECIFIC LEARNER EXPECTATIONS

ATTITUDES

Students will be encouraged to develop:

1. awareness and appreciation of the effects of geological change over long periods of time
2. respect for the power of geological forces
3. appreciation of the dependence of humankind on the physical earth
4. awareness of the role of theory in interpreting earth changes
5. confidence in personal ability to interpret geological materials and changes

SKILLS

Students will demonstrate the following science inquiry skills, with emphasis on those skills that appear in boldface.

1. Questioning
   - **recognizing patterns in changes to the earth's surface**
   - **identifying and asking relevant questions**
2. Proposing Ideas
   - **hypothesizing relationships between observed characteristics of earth materials and the processes that may have caused them**
   - **predicting based on interpretation of present changes**
3. Designing Experiments
   - identifying and controlling variables
   - developing experimental procedures
4. Gathering Data
   - **observing rock formations**
   - **observing landforms and changes**
   - **measuring**
5. Processing Data
   - **classifying rocks according to simple characteristics (e.g., hardness, fracture, cleavage)**
   - **organizing and presenting data**
6. Interpreting Data
   - **inferring relationships between observed earth changes and processes which may cause these changes**
   - developing theoretical explanations

CONCEPTS

1. Evidence of earth changes can be found through observation of ongoing changes and by interpretation of surface features.

   Students will be expected to :

   - describe evidence and effects of earthquakes

- describe patterns in earthquake distribution
- recognize and interpret examples of folding and faulting
- infer patterns in the structure and distribution of mountain formations (with particular emphasis on western North America)
- describe the structure and development of fold and fault mountains
- identify and describe examples of ongoing crustal movements
- infer patterns in crustal movement
- locate general distribution of volcanoes on a world map
- describe the structure and development of volcanoes
- interpret volcanic features and materials
- interpret the relationship between earthquake locations and the distribution of volcanoes on the earth's surface

2. Rock characteristics can be interpreted in relation to the formations in which they are found.

Students will be expected to:

- identify common rocks by observation and simple tests
- identify component materials in common rocks
- recognize and interpret examples of major rock groups
- interpret rock composition and structure in relation to processes of rock formation and change

3. Sedimentary rock formations provide a basis for interpreting earth changes.

Students will be expected to:

- recognize sedimentary rock formations
- describe processes by which sediments accumulate and by which sedimentary rocks form
- describe hypotheses regarding fossil formation
- identify the portions of living things that are most likely to be preserved by fossilization
- identify kinds of rocks where fossils are likely to be found
- recognize and interpret examples of fossils
- infer general characteristics of some organisms based on fossil remains
- describe patterns in the appearance of different life forms as indicated by the fossil record
- recognize the basis on which the relative age of rock formations is interpreted
- recognize the major divisions of the geological time scale

5. Growing Plants

OVERVIEW

The major emphasis of this unit is on science, technology and society. Opportunities are also provided to support learning regarding technologies and the nature of science.

An introductory treatment of plant structures and functions provides a background knowledge leading to a study of growth habits and needs of plants. These understandings are extended as students carry out a variety of plant observation and growth activities, which provide first-hand knowledge of plant culture and care. Activities also focus attention on human actions and interventions that affect the variety, distribution and growth of plants.

SPECIFIC LEARNER EXPECTATIONS

ATTITUDES

Students will be encouraged to develop:

1. respect for living things
2. appreciation of the various roles of plants in sustaining human life
3. awareness that the distribution and growth of plants is very much affected by human interventions and environmental modifications
4. awareness that the survival and distribution of many plant forms is in jeopardy
5. awareness that agricultural plant varieties are usually the product of intensive breeding
6. confidence in personal ability to nurture healthy plants

SKILLS

Students will demonstrate the following decision-making skills, with emphasis on those skills that appear in boldface.

1. Understanding the Problem
   - **identifying plant growth problems**
   - **identifying desirable plant characteristics**
2. Developing a Plan
   - **identifying alternate techniques that might be used to meet plant needs**
   - **developing a plan for testing the effectiveness of alternative techniques for plant growth**
   - **selecting procedures for planting and growth that take advantage of available conditions and materials**
3. Carrying Out the Plan
   - conducting a test of alternate methods of plant growth
   - **troubleshooting plant growth problems:**
     - **identifying problems due to inappropriate environmental conditions**
     - **identifying problems resulting from diseases or pests**
     - **improvising practical remedies to problems encountered**
4. Evaluating
   - **evaluating methods of plant propagation and culture**

CONCEPTS

1. Plant breeding leads to the development of plants with specialized characteristics

   Students will be expected to:

   - identify desirable plant characteristics
   - infer the adaptive and economic value of different plant characteristics
   - describe the use of selective breeding in the production of new plant varieties

2. Plant propagation may be carried out by use of vegetative processes as well as by use of seed.

The student will be expected to:

- identify and describe flower parts and their functions
- conduct a germination study and compute the germination rate based on results obtained
- describe the propagation of plants by vegetative techniques; e.g., leaf or stem cuttings
- describe patterns of growth for plants, both at the macroscopic and the cellular level

3. Life processes of plants are carried out by specific plant structures.

Students will be expected to:

- identify and describe major root and leaf structures of vascular plants
- describe and interpret life processes of plants; i.e., osmosis, transpiration, gas exchange, photosynthesis
- interpret variation in the structure and function of plant roots and leaves
- predict and interpret responses of plant structures to varying environmental conditions

4. Soil characteristics can be enhanced or degraded.

Students will be expected to:

- identify soil components and nutrients
- describe the functional value of soil components relative to plant needs
- describe characteristics of different kinds of soils
- identify practices that may enhance or degrade soils in particular applications (e.g., tillage techniques, use of crops to stabilize or to enrich soil)

5. Plant growth can be modified by controlling environmental conditions.

- describe the growth of a plant, using both qualitative and quantitative observations
- compare growth patterns of two or more plants
- compare growth requirements of two or more plants
- design a plant growth investigation in which plant growth is observed in relation to variation in growth conditions. This investigation may focus on (but is not limited to) the following:
    - manipulation of light conditions: photoperiod, intensity of light, quality of light to suit needs of plants
    - addition of measured quantities of fertilizers and/or growth supplements to plants
    - growth of plants in hydroponic solution

6. Plants react to changing environmental conditions and to the actions of various pests and diseases.

- identify and interpret abnormalities in plant growth
- infer possible causes of ill health in plants observed
- describe and interpret consequences of application of plant herbicides, pesticides or biological controls
- identify alternatives for pest control and describe the relative merits of these alternatives in a particular application

6. Interactions and Environments

OVERVIEW

The major emphasis of this unit is on the nature of science. Opportunities are also provided to support learning regarding technologies and the relationship among science, technology and society.

This unit engages students in the scientific study of living things in relationship to their environments.

Food and energy flows within environments are examined, leading to a study of specific roles of organisms within their physical and biological environment. Relationships of organisms to abiotic factors are studied, as well as relationships within the biotic environment. Effects of humans through interventions such as pesticides, herbicides and pollutants are also studied.

SPECIFIC LEARNER EXPECTATIONS

ATTITUDES

Students will be encouraged to develop:

1. awareness of the complex interrelationships among living things and their environments
2. awareness of the nature and extent of impacts on environments caused by human actions
3. awareness of the need to monitor and manage environments
4. concern and commitment for the maintenance of life-supporting environments

SKILLS

Students will demonstrate the following science inquiry skills, with emphasis on those that appear in boldface.

1. Questioning
   - **recognizing patterns and discrepant events**
   - **identifying and asking relevant questions**
2. Proposing Ideas
   - **hypothesizing relationships among specific living things**
   - **hypothesizing relationships between specific living things and abiotic conditions of their environment**
   - **predicting the effects of given abiotic conditions on the health and distribution of living things in an environment**
3. Designing Experiments
   - identifying and controlling variables
   - **developing experimental procedures**
4. Gathering Data
   - **observing living things in their environments**
   - **observing the distribution of living things in environments**
   - measuring
5. Processing Data
   - **classifying living things within a study plot**
   - **organizing and presenting data**
6. Interpreting Data
   - **inferring evidence of relationships between living things**
   - **inferring the effect of environmental conditions on the distribution of living things in an environment**
   - developing theoretical explanations

CONCEPTS

1. Environments can be described in terms of abiotic conditions.

   Students will be expected to:

   - identify, observe and measure abiotic factors in environments
   - classify and describe an environment in terms of the abiotic factors that characterize it

2. The interdependence of living things is evident in the interactions of organisms with each other and with their environments.

   Students will be expected to:

   - interpret distribution patterns of living things within their environments
   - interpret plant and animal behaviours that indicate dependencies for food or for other needs
   - recognize examples of parasitism, commensalism and mutualism
   - classify animals within an ecosystem as producers, consumers and decomposers
   - infer food chain relationships within an ecosystem
   - identify energy flows within an ecosystem

3. Within environments, specialized forms of life can often be found. The environmental needs of these living things can be inferred from their distribution and from their life habits.

   Students will be expected to:

   - identify and describe habitats and microhabitats
   - infer specializations that are appropriate to organisms in particular habitats
   - identify niches within an environment
   - identify examples of variation in light, soil and temperature needs of organisms
   - predict the effect of minor changes in characteristics of an animal or plant on its ability to survive in a given environment
   - predict the effect of changes in environmental conditions on the ability of particular plants and animals to survive in that environment

4. Environmental interventions can be found to have both intended and unintended consequences.

   Students will be expected to:

   - identify intended purposes and consequences (positive and negative) of human activities in local environments
   - predict consequences of selective addition or removal of living things from an environment
   - predict consequences of the addition of pesticides, herbicides or other pollutants to an environment
   - describe the effects of food chains and food pyramids on the concentration of pollutants in living things

D. LEARNING RESOURCES

BASIC LEARNING RESOURCES

GRADE EIGHT

Science Directions 8 by W.C. Durward et al. John Wiley and Sons, Arnold Publishing, 1990.

Science Plus Technology Society 8 by C.P. McFadden et al. Harcourt Brace Jovanovich, Canada, 1990.

RECOMMENDED AND SUPPLEMENTARY LEARNING RESOURCES

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